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Survey of the Construction and Utility of PET Virtual Workshops

by

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1 Introduction

Over the six-week period of September 15 – October 24, 1997, Cornell Theory Center (CTC) provided a Virtual Workshop on "Parallel Computing and Programming Languages" that was sponsored by the DoD HPC Modernization Program. This workshop was held over the World Wide Web with participants able to download course materials and make use of the IBM SP from the CTC. Since the CTC Virtual Workshop is a possible remote training environment, this workshop was monitored to judge the effectiveness of virtual workshops for presentation of PET training materials.

The next section gives a brief overview of the various parts that CTC combines to create a virtual workshop. Following this are some thoughts and observations on the effectiveness of such training and how well such a virtual workshop format might be utilized for future CEWES MSRC PET training.

2 Parts of the Workshop

There are five major components that make up the CTC Virtual Workshop: course modules, quizzes, lab exercises, the Workshop Companion and support facilities. Each are described in more detail below.

2.1 Modules

The CTC Virtual Workshop "Parallel Computing and Programming Languages" was made up of four major topics: Parallel Programming, Message Passing Interface, High Performance Fortran and Performance. There were eleven individual modules distributed amongst the four topics which included an introduction to the IBM SP and the Parallel Operating Environment (POE). Each module was a set of web pages featuring both text and graphics. There were two methods of interaction offered to the student: the Presentation Layer and the Discussion Layer.

The Presentation Layer contained abbreviated text that was intended for perusal by someone familiar with the topic but interested in reviewing the important points. It was very much like what one would find on overhead slides presented by an instructor teaching the material. The Discussion Layer presented the same material in a much more in-depth

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fashion. Rather than bulleted lists of sentence fragments, whole paragraphs would be devoted to the explanation of individual items of interest.

At the outset of the module, the student would choose which level of detail would best suit him/her, based on previous experience with the topic. After each section within the module, a clickable button was available to switch between the two layers of instruction if more or less detail was desired on upcoming sections within the current module.

Each module had an attached evaluation form that was to be submitted electronically upon completion of the module. The purpose was to give some immediate feedback to the CTC on the complexity of the material presented and the presentation itself. It was also possible to comment on aspects that the student may have thought were done particularly well or could be improved within the module. Progress surveys to determine how much material students had been able to cover in the virtual workshop and what they expected to accomplish were requested every two weeks from the workshop coordinators. A final, overall evaluation was also requested at the end of the six-week period.

2.2 Quizzes

At the end of each module was a multiple-choice quiz to test the student's comprehension of the material presented in the just-completed module. Answers were chosen by clicking on the radio button associated with the desired response. After all questions had been addressed, the student submitted the quiz for automatic grading. The grading system returned a report identifying which questions were answered correctly, which were answered incorrectly and which were not answered by the student. Optionally, the student could also request an explanation of the answers be returned in order to determine why his/her original answers were incorrect.

2.3 Labs

Several modules contained programming lab exercises. The first were introductory labs to familiarize the student with compiling and running parallel programs (previously written by CTC staff members) on the CTC IBM SP machine. Labs in the subsequent modules dealt with adding various parallel functionality to serial and simple parallel codes. Correct solutions were always provided for students who may have needed a hint or who were unable to develop a working program.

2.4 Workshop Companion

The most unique part of the CTC Virtual Workshop was the Workshop Companion, a Java applet that allowed the student to login to the SP, copy lab files from a common directory into the student's own directories, edit, compile and run programs without the use of a separate telnet window. This optional feature was only available for the latter half of the lab exercises after the student had previously been exposed to performing all of the above within a telnet session.

After logging on through the Workshop Companion's initial screen, the student selected one of the pre-loaded lab sets from a pull-down menu. The student was then given the opportunity to copy the files to a place within his/her own home directory. From the "Program" pull-down menu, the student was able to edit, compile or run codes.

A choice of three editors were given (emacs, vi and primitive). After selecting one, the student chose a file to edit. A separate window, with the chosen editor running on the chosen file, would appear and the student could edit the file. By saving the file without exiting the editor, the student could make future changes to the program without having to return to the edit screen to relaunch the editor.

Another choice from the "Program" pull-down menu allowed the student to compile his/her programs. A suggested compilation command line was provided which could be altered as required by the student. Clicking on the "Select Compile" button submitted the command. Upon completion, the results of the compilation were displayed.

To run a successfully compiled program, the "Run" command was selected from the pull-down menu. The displayed window contained a suggested execution command which could be changed. Also given were suggested values for relevant POE variables to be used in the execution of the program. Any or all of these could be changed. Clicking on the "Submit Run" button executed the command line with the addition of POE flags and their values selected by the student. Results of the code being run on the CTC IBM SP were displyed as they were generated.

2.5 Help Desk and Other Support

During regular business hours (9–5 Eastern Time, Monday through Friday), consultants were available by e-mail to answer questions about Virtual Workshop materials. If a question was asked outside of these hours, it was usually answered within 24 hours of transmission (weekends excluded). Buttons were placed at the end of sections within the body of modules. These buttons brought up pre-addressed mail windows to be used immediately to ask a question while the student had the unclear material right at hand.

Buttons to jump to relevant FAQs were placed at appropriate points within the text of modules. A glossary was hyperlinked to words that might be unfamiliar to the student. Clicking such a word brought up another web browser window positioned at the term, along with its definition.

3 Effectiveness

The most apparent advantage of the CTC Virtual Workshop was that it allowed participants to work at anytime, anyplace, any pace. Original literature on this particular workshop estimated total time to complete all modules and lab exercises at 32 hours. Within a six-week time frame, it is quite conceivable that even someone working busy eight-hour days should be able to squeeze out 32 hours to devote to the class.

For greatest success, the size and content of each module must be carefully considered: neither too much information, nor too little, and written with enough detail to eliminate

the need for immediate attention from an instructor. Also, lab exercises reinforcing the covered material are essential, especially in programming related topics. Though very little presented in the workshop materials was new to me, I felt that the CTC Virtual Workshop accomplished the above goals. Since they know their audience will have a very diverse background of experience, the evaluation forms at the end of each module are necessary to ensure and maintain presentations at the proper level.

4 Use by CEWES MSRC

The idea and execution of virtual workshops would certainly be possible through PET. The expertise to create and administrate such workshops is available within the program, not only at the CEWES MSRC, but with help and cooperation with other MSRC sites. Such workshop offerings would be attractive to those users who are not located physically close to a MSRC, yet would still wish to participate in workshop offerings.

What types of virtual workshop offerings would be possible? Several topics spring to mind: programming languages (Fortran 90, HPF, C++), programming paradigms (MPI, PVM), compiling and running codes on particular machines and any programming or analysis or debugging tool. Practically anything that could be taught by an instructor with a set of slides or found in a textbook would be a good candidate. (Slide presentations could form the basis of a Presentation Layer while more detailed explanations taken from lecture given to accompany those slides could form a Discussion Layer.) This is especially true if hands-on laboratory exercises could be created to reinforce, demonstrate or practice topics within the module text.

Each module of the CTC Virtual Workshop was self-contained with pointers to other modules (sometimes not within the framework of the current workshop) for possible needed background. This led me to believe that CTC has a large repertoire of modules that can be combined to create many differently focused workshops. Such a large collection of modules to draw upon is likely the result of creating and hosting many virtual workshops on related topics over the course of a few years.

An initial PET virtual workshop would need a set (8–12) of well thought out modules in support of a particular topic. A second workshop within a related topic might draw upon some of the introductory modules from the first workshop, saving some work over the previous effort. Reuse of modules, especially early in the creation of a set of PET virtual workshop offerings, would be of great benefit.

The design of a PET virtual workshop should begin with the definition of a collection of modules and labs to go along with the module content. Keeping each module focused and self-contained would allow multiple module writers to work on a single workshop. These can then be brought together by a workshop coordinator into a single coherent entity.

It would not be necessary to carry all the bells and whistles provided by the CTC Virtual Workshop. The bulk of the CTC Virtual Workshop is HTML and CGI. Perhaps the most complicated feature is the Workshop Companion. Since the student had to first access the target machine through a telnet window, I found the Workshop Companion to be more a hindrance than a help. The only feature that was better executed in the

Companion was the copying of files from the common directory to the student's chosen directory. However, providing the proper command within the text of the lab allowed me to cut and paste from the web browser to the telnet window and copy all the files needed.

There would be a certain amount of support effort that would be expected, most likely from module authors. While an immediate response to student questions via e-mail may not be feasible, it would be hoped that someone with appropriate knowledge could address questions within a reasonable amount of time. Also, the need for computer accounts by workshop participants must be addressed. It may be necessary to restrict workshop participation to only those with current CEWES MSRC accounts or for those eligible for and who apply for local accounts. It may be possible that special workshop accounts could be created for those participants who do not have existing accounts, but would be eligible for them; e.g., already have DoD accounts on other sites.

5 Conclusion

The virtual workshop format would be a plausible solution for presenting introductory and technical workshops to a wide-ranging audience through PET. The expertise for both creation of content and the delivery system are currently available.